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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/615,630	07/09/2003	Jiang Yan	2003 P 51686 US	1460

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SLATER & MATSIL, L.L.P.
17950 PRESTON RD, SUITE 1000
DALLAS, TX 75252-5793

EXAMINER

LEE, CALVIN

ART UNIT PAPER NUMBER

2825

DATE MAILED: 02/27/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/615,630

Applicant(s)

YAN ET AL.

Examiner

Lee Calvin

Art Unit

2825

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-21 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-5, 7, 9-13, 15 and 17-21 is/are rejected.
- 7) ☒ Claim(s) 6, 8, 14 and 16 is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 09 July 2003 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. ____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____. |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>2</u> . | 6) <input type="checkbox"/> Other: ____. |

OFFICE ACTION***Drawings***

1. Figures 2-5 should be designated by a legend such as --Prior Art-- because only that which are old are illustrated. See MPEP § 608.02(g).
2. Figures 13-14 are objected to as failing to comply with 37 CFR 1.84(p)(4) because reference character "412" has been used to designate both second region and low-voltage active area. Corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:
The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.
4. Claim 21 is rejected under 35 USC 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. There is no support related to "hard mask depositing high density plasma oxide".

Claim Rejections - 35 U.S.C. § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:
(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
6. Claims 1-3, 5, 8-11, 13, 17-18, and 20 are rejected under 35 U.S.C. 102(b) as being anticipated by *Applicant's Prior Art (APA)*.
 - a) *APA* discloses a method of forming isolating regions of a semiconductor device, comprising the steps of:
 - providing a workpiece **202** having at least one first region **207** and one second region **210**, wherein the first region comprising one high voltage active area **208** and the second region comprising one low voltage active area **212** [Fig. 5]
 - patterning the first region with one deep trench **214** having sidewalls, a bottom, and a first depth within the workpiece
 - forming a first insulating layer **216** over the deep trench sidewalls and bottom [Fig. 3]
 - depositing a semiconductive material **218** in the deep trench over the first insulating layer [page 8]
 - masking the first and second regions using a photoresist **232** as a mask (or hard mask)

- patterning the first and second regions with a shallow trench having a second depth less than the first depth, thereby resulting the semiconductive material being recessed beneath the workpiece's top surface by a gap h_2 [page 9]
 - removing the mask over both first and second regions [paragraph 0027]
 - depositing an insulating material in the shallow trench to form a shallow trench isolation region 224, and on the semiconductive material recess to form another shallow trench isolation region 224a aligned on the deep trench
 - forming the low voltage active area 212 in the second region
- b) In re claims 9 and 17, *APA* discloses that a depth of the semiconductor material recess is equal to the shallow trench second depth.

Claim Rejections - 35 U.S.C. § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. Claims 7 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over *Applicant's Prior Art* in view of *Divakarumi et al (US 6,184,107)*.

APA fails to disclose depositing the semiconductive material in the deep trench over the first insulating layer and recessing the semiconductive material below the workpiece top surface.

Divakarumi et al, teaching isolation-region formation that is compatible with *APA*, discloses that a deep trench is filled with a poly-Si material, which is subsequently recessed below the trench opening at the upper level of the substrate [Fig.14 and col. 3, ln.59].

It would have been obvious to one of ordinary skill to have modified the process of *APA* by utilizing a self-alignment process for the purpose of ensure that the critical overlap tolerance between the active area level and deep trench level is increased and there is a good conduction path from the active area through the strap and into the deep trench storage capacitor [col. 7].

9. Claims 4, 12, 19, and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over *Applicant's Prior Art* and *Divakarumi et al* in view of *Mandelman et al (US 6,284,593)*.

a) *Divakarumi et al* also suggests a collar 40 comprised of silicon dioxide but not a thin oxide layer over a thin nitride layer. *Mandelman et al* discloses that a deep trench 15 is lined/covered with a thin oxide layer 35 over a thin nitride layer 30 [Fig. 6A and col. 6].

It would have been obvious to one of ordinary skill to have modified the collar of *APA* and/or *Divakarumi et al* by utilizing an oxynitride collar for the purpose of ensure absolute isolation between the workpiece and the subsequent semiconductive material filled the deep trench.

b) In re claims 19 and 21, *Mandelman et al* also suggests the hard mask formed by depositing BSG. Furthermore, Mandelman et al suggests depositing HDP (high density plasma) oxide [col. 6].

It would have been obvious to one of ordinary skill to have modified the hardmask of *APA* and/or *Divakarumi et al* by utilizing a BSG hardmask because the workpiece material usually has higher etch rate than those of BSG, TEOS, and HDP oxide.

Allowable Subject Matter

10. Claims 6, 8, 14, and 16 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. None of the cited arts teaches either the second insulating layer comprised of a thin nitride over a thin oxide, or the width of the shallow trench.

Contact Information

11. Any inquiry concerning this communication from the Examiner should be directed to *Calvin Lee* at (571) 272-1896 from 7:00 to 17:00 (Monday-Thursday). If attempts to reach the examiner by telephone are unsuccessful, Art Unit 2825's Supervisory Patent Examiner *Matthew Smith* can be reached at (571) 272-1907.

Any inquiry relating to the status of this application should be directed to the Group receptionist whose telephone number is (703) 308-0596. The fax phones are (703) 872-9318 for regular communications and (703) 872-9319 for After-Final communications.



Calvin Lee

Patent Examiner